

CLAIMS

1. A composite processing apparatus comprising:

a substrate holder for holding a substrate;

5 a processing table including a mechanical processing section for processing a surface of the substrate by a processing method involving a mechanical action, and an electrolytic processing section, provided separately from the mechanical processing section and having a processing electrode provided
10 with an ion exchanger, for processing the substrate by applying a voltage between the processing electrode and the substrate while keeping the ion exchanger in contact with the substrate;

a liquid supply section for supplying a liquid between the substrate and the processing electrode, and between the
15 substrate and the mechanical processing section; and

a drive section for moving the substrate and the processing table relative to each other.

2. The composite processing apparatus according to claim
20 1, wherein during the relative movement between the substrate and the processing table, the processing electrode passes a portion to be processed of the substrate held by the substrate holder, and the mechanical processing section subsequently passes the portion to be processed.

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3. The composite processing apparatus according to claim 2, wherein the mechanical processing section passes the portion to be processed of the substrate within one second after the

processing electrode has passed the portion to be processed.

4. The composite processing apparatus according to claim 1, wherein the mechanical processing section has a processing surface composed of a fixed abrasive.

5. The composite processing apparatus according to claim 1, wherein the mechanical processing section has a processing surface composed of a polishing pad, and a slurry supply section for supplying a slurry to the processing surface.

6. The composite processing apparatus according to claim 1, wherein the processing table includes said processing electrode and said mechanical processing section both in numbers and further includes a number of feeding electrodes for feeding electricity to the substrate, and wherein the processing electrodes and the feeding electrodes are disposed alternately at regular intervals and each processing electrode is disposed between adjacent mechanical processing sections.

7. The composite processing apparatus according to claim 6, wherein the processing table makes a scroll movement.

8. The composite processing apparatus according to claim 1, wherein the processing table has a disk-like shape, the processing electrode extends in the radial direction of the processing table, and feeding electrodes for feeding electricity to the substrate are disposed on both sides of the processing

electrode.

9. A composite processing apparatus comprising:

a substrate holder for holding a substrate;

5 a processing table including a fixed-abrasive processing section for polishing a surface of the substrate by a processing method involving a mechanical action by a fixed abrasive containing abrasive grains, and an electrolytic processing section, separately provided from the fixed-abrasive processing
10 section and having a processing electrode, for processing the substrate by applying a voltage between the processing electrode and the substrate;

a drive section for moving the substrate and the processing table relative to each other; and

15 a liquid supply section for supplying a liquid between the substrate and the processing electrode, and between the substrate and the fixed abrasive.

10. The composite processing apparatus according to claim
20 9, wherein during the relative movement between the substrate and the processing table, the processing electrode passes a portion to be processed of the substrate held by the substrate holder, and the fixed-abrasive processing section subsequently passes the portion to be processed.

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11. The composite processing apparatus according to claim 10, wherein the fixed-abrasive processing section passes the portion to be processed of the substrate within one second after

the processing electrode has passed the portion to be processed.

12. The composite processing apparatus according to claim 9, wherein the processing table includes said processing electrode and said fixed-abrasive processing section both in numbers and further includes a number of feeding electrodes for feeding electricity to the substrate, and wherein the processing electrodes and the feeding electrodes are disposed alternately at regular intervals and each processing electrode is disposed between adjacent fixed-abrasive processing sections.

13. The composite processing apparatus according to claim 12, wherein the processing table makes a scroll movement.

14. The composite processing apparatus according to claim 9, wherein the processing table has a disk-like shape, the processing electrode extends in the radial direction of the processing table, and feeding electrodes for feeding electricity to the substrate are disposed on both sides of the processing electrode.

15. A composite processing method comprising:

separately providing a mechanical processing section for processing a surface of a substrate by a processing method involving a mechanical action, and an electrolytic processing section, having a processing electrode provided with an ion exchanger, for processing the substrate by applying a voltage between the processing electrode and the substrate while keeping

the ion exchanger in contact with the substrate; and

carrying out processing of a surface of a substrate by moving the substrate and the mechanical processing section relative to each other and moving the substrate and the processing
5 electrode relative to each other.

16. A composite processing apparatus comprising:

a holder for holding a workpiece;

a fixed-abrasive processing section for processing a
10 surface of the workpiece by a processing method involving a mechanical action by a fixed abrasive containing abrasive grains;

an electrolytic processing section, having a processing electrode capable of coming close to the workpiece and a feeding
15 electrode for feeding electricity to the workpiece, for processing the workpiece by applying a voltage between the processing electrode and the feeding electrode;

a power source for applying the voltage between the processing electrode and the feeding electrode;

20 a liquid supply section for supplying a liquid between the workpiece and the processing electrode and/or the feeding electrode, and/or between the workpiece and the fixed-abrasive processing section; and

a drive section for moving the workpiece and the
25 fixed-abrasive processing section relative to each other, and moving the workpiece and the electrolytic processing section relative to each other.

17. The composite processing apparatus according to claim 16, wherein the processing electrode and/or the feeding electrode is provided with an ion exchanger to be disposed between the electrode and the workpiece.

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18. The composite processing apparatus according to claim 16, wherein during the relative movement between the workpiece and the fixed-abrasive processing section and the relative movement between the workpiece and the electrolytic processing section, the fixed-abrasive processing section passes a portion to be plated of the workpiece held by the substrate holder, and the electrolytic processing section subsequently passes the portion to be processed.

15 19. The composite processing apparatus according to claim 16, wherein the composite processing apparatus includes at least two types of the fixed-abrasive processing section comprising fixed abrasives having different surface roughnesses.

20 20. The composite processing apparatus according to claim 16, wherein the fixed abrasive has a surface roughness of not more than 10 μm .

21. The composite processing apparatus according to claim 25 16, wherein the liquid is pure water, a liquid having an electric conductivity of not more than 500 $\mu\text{S/cm}$ or an electrolytic solution.

22. The composite processing apparatus according to claim 16, wherein an ion exchanger is disposed between the processing electrode and the workpiece, and a separate ion exchanger is disposed between the feeding electrode and the workpiece.

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23. The composite processing apparatus according to claim 16, wherein a pressure of not more than 10 psi (69 kPa) is applied between the workpiece and at least one of the processing electrode, the feeding electrode and the fixed abrasive.

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24. The composite processing apparatus according to claim 16, wherein the fixed-abrasive processing section and/or the electrolytic processing section moves closer to or away from the workpiece.

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25. The composite processing apparatus according to claim 24, wherein after processing the workpiece with the fixed-abrasive processing section by bringing it into contact with the workpiece, the fixed-abrasive processing section and/or the electrolytic processing section is so moved as to process the workpiece only with the electrolytic processing section.

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26. A composite processing apparatus comprising:
a holder for holding a workpiece;

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a mechanical processing section for processing a surface of the workpiece by a processing method involving a mechanical action;

an electrolytic processing section, having a processing

electrode provided with an ion exchanger and capable of coming close to the workpiece and a feeding electrode for feeding electricity to the workpiece, for processing the workpiece by applying a voltage between the processing electrode and the feeding electrode;

a liquid supply section for supplying a liquid between the workpiece and the electrolytic processing section, and/or between the workpiece and the mechanical processing section; and

a drive section for moving the workpiece and the mechanical processing section relative to each other, and moving the workpiece and the electrolytic processing section relative to each other.

27. The composite processing apparatus according to claim 26, wherein the mechanical processing section and/or the electrolytic processing section moves closer to or away from the workpiece.

28. The composite processing apparatus according to claim 27, wherein after processing the workpiece with the mechanical processing section by bringing it into contact with the workpiece, the mechanical processing section and/or the electrolytic processing section is so moved as to process the workpiece only with the electrolytic processing section.

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29. A composite processing method comprising:

providing a fixed-abrasive processing section for processing a surface of a workpiece by a processing method

involving a mechanical action by a fixed abrasive containing abrasive grains, and an electrolytic processing section, having a processing electrode and a feeding electrode, for processing the workpiece by applying a voltage between the processing
5 electrode and the feeding electrode; and

carrying out processing of a surface of a workpiece by moving the workpiece and the fixed-abrasive processing section relative to each other, and moving the workpiece and the electrolytic processing section relative to each other.

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30. The composite processing method according to claim 29, wherein after processing the workpiece with the fixed-abrasive processing section by bringing it into contact with the workpiece, the workpiece is processed only with the
15 electrolytic processing section.

31. A composite processing method comprising:

providing a mechanical processing section for processing a surface of a workpiece by a processing method involving a
20 mechanical action, and an electrolytic processing section, having a processing electrode provided with an ion exchanger, for processing the workpiece by applying a voltage between the processing electrode and the workpiece while keeping the ion exchanger in contact with the workpiece; and

25 carrying out processing of a surface of a workpiece by moving the workpiece and the mechanical processing section relative to each other, and moving the workpiece and the electrolytic processing section relative to each other.

32. The composite processing method according to claim 31, wherein after processing the workpiece with the mechanical processing section by bringing it into contact with the workpiece, the workpiece is processed only with the electrolytic processing
5 section.